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HARTCROWSER
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January 11, 2001

Mr. John Childs
Project Manager, Environmental Resources
Port of Portland
P.O. Box 3529
Portland, Oregon 97208

Re: Sampling and Analysis Plan for the Terminal 5, Berth 503, and Terminal 6, Berths 603-605 Water Quality Monitoring Program
J-15045

Dear Mr. Childs,

Hart Crowser is pleased to present this Sampling and Analysis Plan (SAP) to conduct a field sampling and chemical analysis program that characterizes the water quality during the dredging of Terminal 5, Berth 503, and Terminal 6, Berths 603-605, sediments.

INTRODUCTION

Hart Crowser understands that the Port of Portland is going to dredge sediments at Terminal 5, Berth 503, and Terminal 6, Berths 603-605, and discharge this material to the sediment rehandling facility located near Suttle Road. The purpose of this SAP is to present the procedures Hart Crowser will use to collect water quality data during dredging at these berths.

PROGRAM OBJECTIVES

The objectives of the SAP are to:

- Monitor the physical parameters of the water column during dredging. Physical parameters include conductivity, dissolved oxygen, pH, temperature, and turbidity at the top, middle, and bottom of the water column using the Seabird® CTD water quality monitoring instrument.

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- Collect and chemically analyze site water samples for tributyltin (TBT) (total and dissolved), pesticides, polychlorinated biphenyls (PCBs), and total suspended solids (TSS) from the middle of the water column.

WATER QUALITY MONITORING PROGRAM AND WATER SAMPLE COLLECTION, HANDLING, AND CHEMICAL ANALYSIS PROCEDURES

Descriptions of the water quality monitoring program and water sample collection, handling, and chemical analysis procedures are detailed below.

Dredge Site Field Parameter Monitoring using the Seabird® CTD

The water quality monitoring program will include a total of five days of monitoring field parameters using the Seabird® CTD. The Seabird® CTD profiles will be obtained at five distinct stations at each terminal to characterize the dredge plume characteristics. As presented on Figure 1, the physical parameter monitoring locations will be located:

- One location approximately 500 feet upstream of the point of dredging (outside of plume) to be representative of site background conditions;
- One location approximately 50 feet downstream of the point of dredging;
- Two locations approximately 100 feet downstream of the point of dredging; and
- One location approximately 250 feet downstream of the point of dredging.

These proposed monitoring stations might be altered based on site conditions, the location of the turbidity plume, and any differing requirements stated in the DEQ 401 Water Quality Certificate that has yet to be obtained by the Port.

Dredge Site Sampling of Mid-Water Column for Contaminants of Concern

Hart Crowser will assist the Port in assessing site water quality during dredging activities for the absence or presence of chemical contamination. Water samples will be collected from the middle of the water column at locations to be determined on-site based on total water depth. At Berths 603-605, the chemical sampling program will include two days of sampling from one upstream and two downstream locations, yielding a total of six water samples. At Berth 503, the chemical sampling program will include two upstream and two downstream locations, yielding a total of four water samples.

Water samples will be collected using a Niskin bottle. The Niskin bottle is a vertical sampling tube that is lowered through the water column by means of a sampling line to the desired sampling depth. The bottle is then closed with the assistance of a trip weight. When the sampler is full, the water will be retrieved and transferred into pre-cleaned sample containers, labeled, and placed immediately into cooled ice chests until transported to the chemical laboratory. Labels will include the project name, sample identification number, type of analysis to be performed, date and time of sampling, and initials of person(s) preparing the sample, and will be referenced by entry into the logbook. Samples will be stored at approximately 4°C until delivered to the analytical laboratory.

The ten water samples will be submitted to Columbia Analytical Services, Inc., (CAS) in Kelso, Washington for analysis of total and dissolved TBT, pesticides, PCBs, and total suspended solids (TSS). Samples intended for dissolved TBT analysis will be filtered in the field using a peristaltic pump and in-line 0.45 micron filter. CAS will handle and analyze the submitted water samples in accordance with DEQ/EPA analytical testing protocols and QA/QC requirements. A written report of analytical results and QA/QC data will be prepared by CAS and included as an appendix in the final report.

LABORATORY CHEMICAL ANALYSIS

Laboratory testing procedures will be consistent with chemical analyses protocols and detection limit goals presented in Table 8B of the *"Sampling and Analysis Plan for Dredge Material Characterization Terminal 6, Berths 603-605, and Terminal 5, Berth 503"* prepared by Hart Crowser (September 22, 2000). In addition, the Quality Assurance/Quality Control (QA/QC) procedures described in Sections 7.3 through 7.3.6 of the SAP will be implemented during the water quality monitoring program to ensure sample integrity and data quality.

REPORTING

Hart Crowser will prepare a written report documenting all activities associated with monitoring, collection, transportation, and analysis of water samples. The chemical testing report from the analytical laboratory will be included as an appendix. At a minimum, the following will be included in the final report:

- The type of sampling equipment used;
- Protocols and procedures used during sampling and testing, and an explanation of any deviations from the sampling plan protocols;
- Maps identifying locations where the monitoring and water samples were collected;
- Chain of custody procedures used, and an explanation of any deviations from the sampling plan procedures;
- A tabular and graphical summary of physical parameter data collected by the Seabird® CTD; and
- A tabular summary of the chemical testing results, and comparison to relevant state and federal water quality screening criteria.

If you have any questions regarding this SAP, please do not hesitate to contact either of us at (503) 620-7284.

Sincerely,

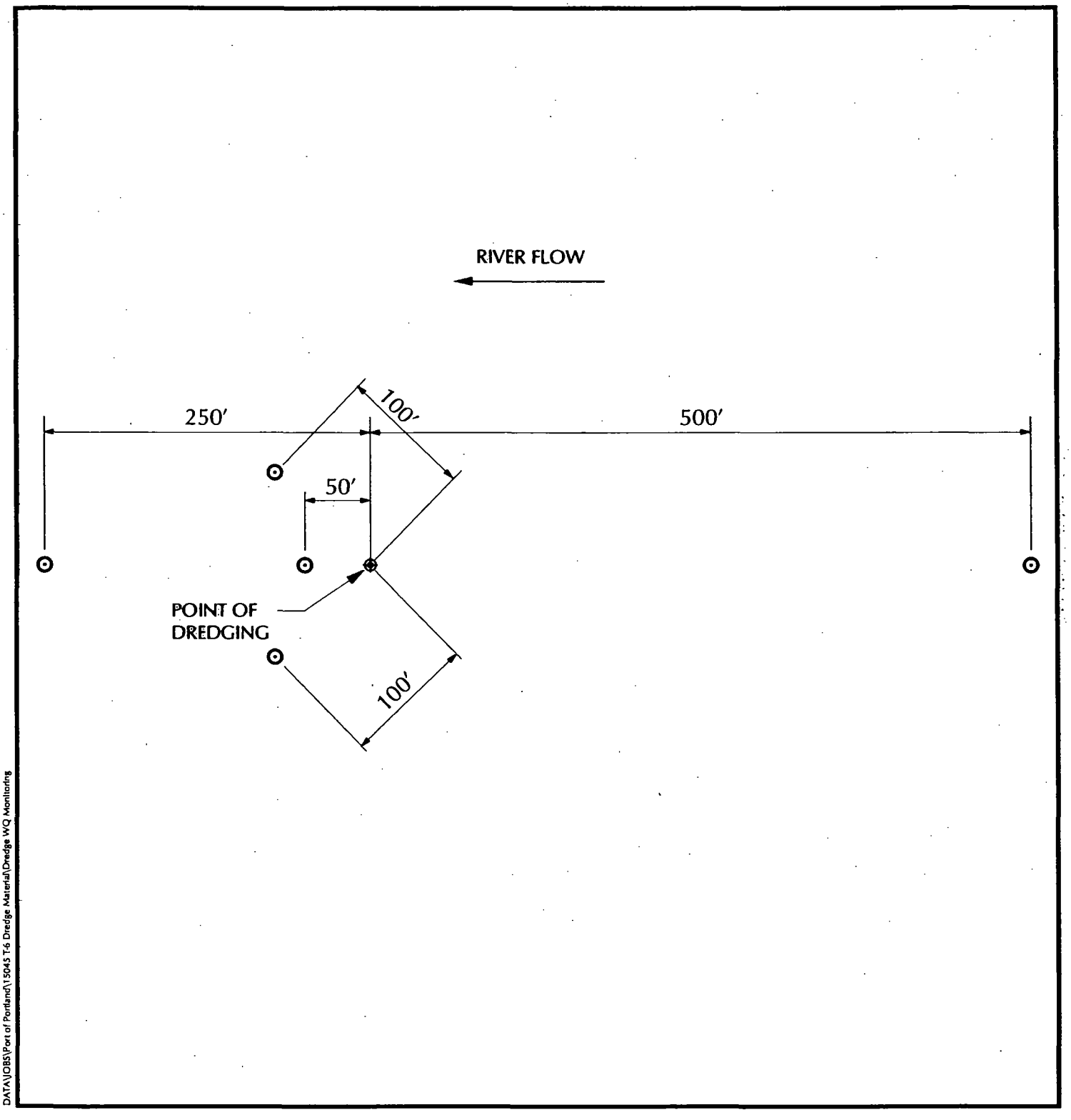
HART CROWSER, INC.

KEITH A. KROEGER
Staff Aquatic Toxicologist

HOWARD L. CUMBERLAND
Associate

Attachments: Figure 1 - Monitoring Locations

Water Quality Monitoring Program
Port of Portland
Portland, Oregon



DATA\JOBS\Port of Portland\15045 T-6 Dredge Material\Dredge WQ Monitoring

Legend

⊙ Seabird® CTD Monitoring Locations

HARTCROWSER

J-15045-01 1/01

Figure 1

HARTCROWSER
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Anchorage
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Denver
Fairbanks
Jersey City
Juneau
Long Beach
Portland
Seattle

May 16, 2001

Mr. John Childs
Project Manager, Environmental Resources
Port of Portland
P.O. Box 3529
Portland, Oregon 97208

Re: Report of Results of the Water Quality Monitoring Program for the Terminal 5, Berth 503, and Terminal 6, Berths 603-605.
J-15045-01

Dear Mr. Childs:

Hart Crowser is pleased to present the results of the water quality monitoring program conducted during the dredging of sediments at Terminal 5, Berth 503, and Terminal 6, Berths 603-605 (Figure 1). This work was conducted in general accordance with Hart Crowser's Sampling and Analysis Plan (SAP) for this project dated January 11, 2001.

INTRODUCTION

The sediment and elutriate quality of the proposed dredge prisms at Terminals 5 and 6 had been characterized by Hart Crowser in the Dredged Material Characterization Study, dated November 20, 2000. Only DDT exceeded the Screening Levels contained in the Dredged Material Evaluation Framework for the Lower Columbia River; however, these exceedences were slight and inconsistent across sampling sites, and the sediments were determined to be within the parameters of suitability for in-water disposal.

In January and early February 2001, the Port of Portland conducted maintenance dredging of sediments at Terminal 5, Berth 503, and Terminal 6, Berths 603-605, and placed this dredge material in the upland sediment rehandling facility located near Suttle Road (Figure 1). Hart Crowser conducted water quality monitoring for *in-situ* physical parameters and collected and submitted water samples for laboratory chemical analyses during dredging activities.

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Water quality monitoring was also conducted at the Suttle Road rehandling facility to document the quality of the effluent return flow to the Columbia River. These results will be presented in a separate report.

PROGRAM OBJECTIVES

The general objectives of this water quality monitoring program were to:

- Collect field data to help assess conformance with the Port's Water Quality Certification issued by the Department of Environmental Quality (DEQ) on January 12, 2001; and
- Collect field and laboratory data to describe the nature and extent of water quality that may be associated with maintenance dredging activities. Because bulk sediment quality indicated that the dredge prisms were generally suitable for in-water disposal, the possibility for turbidity excursions was the primary concern; however, the Port also performed chemical analysis of water column samples to ensure that sedimentary contaminants were adequately contained during dredging.

The specific objectives of this water quality monitoring program were to:

- Monitor the *in-situ* physical parameters of the water column during dredging. Physical parameters include: conductivity, dissolved oxygen, pH, temperature, and turbidity. Measurements were averaged over the top, middle, and bottom portions of the water column using the Seabird® CTD water quality monitoring instrument.
- Collect and chemically analyze site water samples for tributyltin (TBT) (both total and dissolved species), pesticides (in particular DDT), semivolatile organic compounds, and total suspended solids (TSS) from the middle of the water column at the mixing zone boundary downstream from the dredge.

SAMPLING AND ANALYTICAL PROCEDURES

The protocols and procedures used during sampling and chemical analysis are summarized below with an explanation of any deviations from the sampling plan procedures proposed in Hart Crowser's SAP.

Dredge Site Field Parameter Monitoring using the Seabird® CTD

In-situ water quality parameters were monitored over a total of three dredging days using the Seabird® CTD to characterize the physical characteristics of the dredge plume. The

Seabird® CTD profiles were obtained at five stations during one day of dredging at Terminal 5, Berth 503, and two days of dredging at Terminal 6, Berths 603-605. As presented on Figures 2 and 3, the field monitoring locations at Terminal 5, Berth 503, and Terminal 6, Berths 603-605, were located as follows:

- Upstream Station: one location approximately 500 feet directly upstream of the point of dredging (outside of plume) to be representative of site background conditions;
- Mixing Zone Boundary: one location approximately 100 feet directly downstream of the point of dredging;
- Mixing Zone Boundary–Left: one location approximately 100 feet downstream of the point of dredging and to the left of the predominant current direction ("nearshore" at Terminal 6, "offshore" at Terminal 5);
- Mixing Zone Boundary–Right: one location approximately 100 feet downstream of the point of dredging and to the right of the predominant current direction ("offshore" at Terminal 6, "nearshore" at Terminal 5); and
- Downstream Station: one location approximately 250 feet directly downstream of the point of dredging.

During the February 9 monitoring event at Terminal 6, an additional monitoring station was added within the mixing zone at 50 feet downstream from the dredge. Also, during the January 25 monitoring event at Terminal 5, a second monitoring station was added 500 feet upstream from the dredge to assess the inherent variability of water quality in the Willamette River.

Water Column Sampling for Contaminants of Concern

Surface water samples were collected by Hart Crowser to assist the Port in assessing site water quality during dredging activities. Water samples were collected from the middle of the water column at Terminal 5, Berth 503, and Terminal 6, Berths 603-605 at locations presented on Figures 2 and 3, respectively. At Terminal 5, Berth 503, the chemical sampling program included two upstream locations approximately 500 feet upstream to be representative of site background conditions and two downstream locations, yielding a total of four water samples. At Terminal 6, Berths 603-605, the chemical sampling program included one day of sampling from one upstream location approximately 500 feet upstream to be representative of site background conditions and three downstream locations, yielding a total of four water samples.

The ten water samples were submitted to Columbia Analytical Services, Inc. (CAS), in Kelso, Washington for analysis of total and dissolved TBT, pesticides, semivolatiles, and TSS. Samples intended for dissolved TBT analysis were filtered at CAS using a stainless steel filter.

Modifications to the Sampling and Analysis Plan

As presented in the SAP, the water quality monitoring program was scheduled to include five days of monitoring field parameters using the Seabird® CTD (A total of two days at Berth 503 and three days at Berths 603-605). The Hart Crowser monitoring team was mobilized to the field site two times but was unable to monitor or sample due to unexpected conditions. As a result, only one day of monitoring field parameters using the Seabird® CTD at Terminal 5, Berth 503 was accomplished.

On one occasion, dredging was not in progress due to operational delays; therefore, only two days of monitoring field parameters using the Seabird® CTD at Terminal 6, Berths 603-605 was accomplished. Due to unexpected operational delays, only one day of mid-water column sampling was accomplished at Terminal 6. As a result of the one day mid-water column sampling at Terminal 6, an additional mid-water sample was collected yielding a total of four water samples. The additional mid-water column sample location was approximately 50 feet downstream of the point of dredging.

In accordance to the methodology presented in the SAP, mid-water column samples were to be collected using a Niskin bottle. Mid-water column samples were collected at Terminal 5, Berth 503 using a Niskin bottle; however, due to a mechanical failure occurring to the Niskin bottle at Terminal 6, Berths 603-605 (February 2), mid-water column water samples were collected using a 12-volt pump (February 6).

WATER QUALITY MONITORING RESULTS

This section presents the results of the Seabird® CTD profiles obtained at Terminal 5, Berth 503, and Terminal 6, Berths 603-605 to characterize the dredge plume physical characteristics. Physical parameters include conductivity, dissolved oxygen, pH, temperature, and turbidity throughout the entire water column using the Seabird® CTD water quality monitoring instrument.

Terminal 5, Berth 503

pH. The pH measurements recorded at Terminal 5, Berth 503 are presented in Table 1. Downstream of dredging activities, the average pH measurements were within the Water Quality Standards (OAR 340-041-0442) of 6.5 to 8.5 units.

Dissolved Oxygen. Dissolved oxygen (DO) profiles recorded at Terminal 5, Berth 503 are presented in Table 1. The average DO concentrations ranged between 11.86 and 12.13 mg/L. The most stringent of the Water Quality Standards for DO requires that DO be maintained above 11.0 mg/L for salmonid spawning habitat during the periods from spawning to fry emergence [OAR 340-041-0442]. All monitoring locations were in compliance with this criterion.

Turbidity. Turbidity profiles recorded at Terminal 5, Berth 503 are presented in Table 1. The average turbidity measurements at the mixing zone boundary did not exceed the Water Quality Standards (OAR 340-041-0442) of ten percent above the natural background turbidity relative to the control point 500 feet upstream from the point of dredging.

Temperature. Temperature measurements recorded at Terminal 5, Berth 503 are presented in Table 1. The average temperature measurements ranged from 41.3 to 41.7°F, and were well below the water quality threshold (OAR 340-041-0442) of 68°F.

Conductivity. Conductivity measurements recorded at Terminal 5, Berth 503 are presented in Table 1. The average conductivity measurements ranged from 94.1 to 109.5 µmho/cm. No Water Quality Standards exist for conductivity.

Terminal 6, Berths 603-605

pH. The pH measurements recorded at Terminal 6, Berths 603-605 on February 5 and February 9, 2001 are presented in Table 1. The average pH measurements were above the Water Quality Standard (OAR 340-041-0205) of 8.5 during both monitoring events; however, the highest pH measurements were obtained at the upstream monitoring stations during both events. The upstream monitoring locations are considered ambient conditions because they are outside the influence of dredging activities. The Seabird® CTD was subsequently determined to be out of calibration for pH during these events. However, the pH probe is calibrated independently of the other Seabird® CTD probes; therefore, the other data parameters are valid.

Dissolved Oxygen. DO profiles recorded at Terminal 6, Berths 603-605 on February 5 are presented in Table 1. The average DO profiles ranged between 12.93 and 13.17 mg/L. All monitoring locations were in compliance with the most stringent DO criterion of >11.0 mg/L in salmonid spawning areas.

DO profiles recorded at Terminal 6, Berths 603-605 on February 9 are presented in Table 1. The average DO profiles ranged between 12.86 and 13.32 mg/L. All monitoring locations were in compliance with the most stringent DO criterion of >11.0 mg/L in salmonid spawning areas.

Turbidity. Turbidity profiles recorded at Terminal 6, Berths 603-605 on February 5 are presented in Table 1. The average turbidity measurement recorded at the upstream station was 22.00 NTU (depth: -28 to -44 feet). The source of the elevated turbidity at this location is unknown. The average turbidity measurements at the downstream stations did not exceed the Water Quality Standards (OAR 340-041-0205) of ten percent above the natural turbidity as measured relative to the control point immediately upstream of the turbidity causing activity.

Turbidity profiles recorded at Terminal 6, Berths 603-605 on February 9 are presented in Table 1. The average turbidity measurement recorded at the upstream station was 5.09 NTU throughout the entire water column. The average turbidity measurements recorded at the three 100-foot downstream locations were above the ten percent natural turbidity as measured relative to the control point immediately upstream of the turbidity causing activity. These turbidity measurements were recorded only at the bottom depths (-28 to -45 feet), indicating that the turbidity plume is restricted to the bottom depths and is significantly reduced to be similar to background 5.98 NTU at 250 feet downstream.

Temperature. Temperature measurements recorded at Terminal 6, Berths 603-605 on February 5 and February 9 are presented in Table 1. The average temperature measurements ranged from 39.9 to 40.4°F, and were well below the water quality threshold (OAR 340-041-0205) of 68°F.

Conductivity. Conductivity measurements recorded at Terminal 6, Berths 603-605 on February 5 and February 9 are presented in Table 1. The average conductivity measurements ranged from 155 to 169 µmho/cm. No Water Quality Standards exist for conductivity.

LABORATORY CHEMICAL ANALYSIS RESULTS

Analytical results for mid-water column samples collected at Terminal 5, Berth 503, and Terminal 6, Berths 603-605 were below relevant state and federal water quality screening criteria. Chemical analytical data are summarized in Table 2.

Terminal 5, Berth 503

Tributyltin. Total TBT was detected at trace concentrations in three out of four water column samples, including both of the upstream monitoring stations. Detected concentrations of total TBT were well below water quality screening levels, and all downstream concentrations were equal to or lower than upstream ambient concentrations.

Polycyclic Aromatic Hydrocarbons. No polycyclic aromatic hydrocarbons (PAHs) were detected in any water column samples at Terminal 5.

Chlorinated Pesticides. No chlorinated pesticides were detected in any water column samples at Terminal 5.

Terminal 6, Berths 603-605

Tributyltin. Neither total nor dissolved TBT species were detected in any water column samples at Terminal 6.

Polycyclic Aromatic Hydrocarbons. PAHs were not detected in water column samples from the upstream station or from the downstream stations at 50 feet and 100 feet from the point of dredging. At 250 feet downstream from the point of dredging, naphthalene and 2-methylnaphthalene were detected at trace concentrations of 0.043 and 0.024 µg/L, respectively. This naphthalene concentration is orders of magnitude below its surface water screening criteria. No criteria exist for 2-methylnaphthalene. Because these PAHs were not detected closer to the point of dredging, it is unlikely that they were caused by dredging activities.

Chlorinated Pesticides. No chlorinated pesticides were detected in any water column samples at Terminal 6.

CONCLUSIONS

Water quality monitoring of *in-situ* physical parameters at 100 feet downstream from the points of dredging at Terminals 5 and 6 indicates that no turbidity excursions were observed in the upper and middle parts of the water column at any time. These data are consistent with routine visual observations in which no visible turbidity was evident during dredging activities, in compliance with the Port's Water Quality Certification. Evidence of dredging related turbidity was observed in the bottom portion of the water column during the February 9 monitoring event only; however, turbidity decreased rapidly to background values with increasing distance downstream and decreasing water depth.

DO and temperature were in compliance with water quality criteria at all times and locations. pH excursions at Terminal 6 were caused by the Seabird® CTD drifting out of calibration based on manufacturer calibration records following the sampling activities.

Chemical analysis of water column samples for TBT, PAHs, and chlorinated pesticides indicate no significant releases of contaminants occurred during monitoring activities, and no water quality criteria were exceeded for these constituents. These results are consistent with the bulk sediment chemistry of the dredge prisms that showed only low-level chemical concentrations that would generally be suitable for in-water disposal.

Thank you for the opportunity to provide services to you on this project. Please call if you have any questions or require additional information regarding this project.

Sincerely,

HART CROWSER, INC.

KEITH A. KROEGER
Senior Staff Aquatic Toxicologist

HOWARD L. CUMBERLAND
Associate

Attachments:
Table 1 - Water Quality Monitoring Physical Parameter Results
Table 2 - Analytical Results for Mid-Water Column Samples
Figure 1 - Site Location Map
Figure 2 - Water Quality Monitoring Program at Terminal 5, Berth 503
Figure 3 - Water Quality Monitoring Program at Terminal 6, Berths 603-605

Table 1 - Water Quality Monitoring Physical Parameter Results
Port of Portland
Portland, Oregon

Sample Location	Water Depth	pH[1]			DO (mg/L)			Turbidity (NTU)			Temperature (°F)			Conductivity (µmho/cm)		
		Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum	Average
Sample Date January 25, 2001																
T5-Upstream 500'	Top (0-11)	8.28	9.31	8.59	11.05	14.91	12.13	7.81	9.28	8.54	41.59	41.78	41.63	91.52	97.03	94.08
	Middle (11-22)	8.18	8.29	8.22	12.00	12.06	12.03	8.30	9.77	8.72	41.58	41.64	41.60	91.75	94.56	94.43
	Bottom (22-35)	8.12	8.19	8.16	11.94	12.04	11.99	8.79	12.70	10.58	41.57	41.59	41.58	91.82	94.70	94.56
T5-Downstream 100'	Top (0-9)	8.23	8.61	8.36	10.54	12.53	12.18	8.30	9.77	8.89	41.63	41.67	41.65	102.69	108.17	104.00
	Middle (9-18)	8.13	8.24	8.18	11.89	12.03	11.96	8.30	10.74	8.93	41.64	41.68	41.66	100.10	110.81	105.58
	Bottom (18-28)	8.02	8.14	8.09	11.82	11.99	11.91	8.30	11.23	8.94	41.64	41.68	41.66	100.15	124.47	107.03
T5-Downstream 250'	Top (0-10)	8.10	8.46	8.24	10.62	12.44	12.04	7.33	10.26	8.60	41.66	41.80	41.72	97.28	111.05	103.88
	Middle (10-20)	8.00	8.14	8.08	11.83	11.93	11.88	8.30	9.77	8.88	41.69	41.73	41.70	102.87	113.80	108.72
	Bottom (20-30)	8.02	8.07	8.04	11.85	11.91	11.87	8.30	9.77	8.96	41.69	41.71	41.70	108.25	113.73	110.08
T5-Downstream Offshore 100'	Top (0-8)	8.09	8.37	8.19	10.76	12.56	12.00	8.30	10.26	8.92	41.50	41.68	41.60	105.72	124.78	114.31
	Middle (8-16)	8.10	8.14	8.12	11.84	11.89	11.86	8.30	9.77	8.88	41.64	41.69	41.67	110.94	116.41	113.33
	Bottom (16-25)	8.05	8.23	8.12	11.81	12.10	11.95	7.81	9.77	8.71	40.78	41.67	41.26	110.98	142.84	130.42
T5-Downstream Nearshore 100'	Top (0-8)	8.03	8.16	8.07	10.80	12.51	12.06	7.81	10.26	8.63	41.65	41.68	41.66	105.74	108.46	108.37
	Middle (8-16)	7.99	8.06	8.03	11.85	11.94	11.89	8.30	9.77	8.65	41.65	41.68	41.66	108.32	111.09	108.44
	Bottom (16-23)	7.99	8.02	8.00	11.84	11.90	11.87	8.30	10.26	8.76	41.67	41.68	41.67	108.31	111.04	109.46
Sample Date February 5, 2001																
T6-Upstream1 500'	Top (0-14)	9.15	9.65	9.29	12.89	13.53	13.13	3.42	4.88	4.17	39.86	39.94	39.88	166.52	169.63	168.96
	Middle (14-28)	9.14	9.17	9.15	13.03	13.12	13.08	3.42	4.40	4.03	39.86	39.87	39.87	166.82	169.93	168.79
	Bottom (28-42)	8.98	9.16	9.09	11.46	19.34	13.01	3.42	72.77	22.00	39.86	39.88	39.87	167.17	170.02	168.69
T6-Downstream1 100'	Top (0-14)	9.08	9.32	9.14	11.09	13.45	13.09	3.42	5.37	4.12	39.86	39.89	39.87	167.53	170.71	167.81
	Middle (14-28)	8.99	9.10	9.04	12.94	13.04	13.00	3.91	5.86	4.44	39.85	39.87	39.86	167.90	170.82	168.82
	Bottom (28-42)	9.00	9.06	9.02	12.94	13.03	12.99	2.93	6.84	4.01	39.85	39.87	39.87	167.95	170.88	169.23
T6-Downstream1 Offshore 100'	Top (0-14)	8.83	8.99	8.91	11.48	13.69	13.06	3.91	7.81	4.75	39.86	39.88	39.87	167.94	170.91	168.14
	Middle (14-28)	8.90	8.98	8.93	12.90	13.02	12.95	4.88	7.81	6.17	39.85	39.87	39.86	165.58	171.23	168.38
	Bottom (28-44)	8.92	8.99	8.95	12.89	13.00	12.93	6.35	9.77	7.54	39.85	39.86	39.86	168.29	168.42	168.35
T6-Downstream1 Nearshore 100'	Top (0-14)	8.93	8.98	8.96	10.27	13.56	13.17	3.91	7.81	4.21	39.87	39.89	39.88	167.96	171.02	168.21
	Middle (14-28)	8.92	9.00	8.96	12.94	13.07	13.00	3.42	4.88	4.21	39.88	39.89	39.89	168.09	170.90	168.22
	Bottom (28-44)	8.99	9.08	9.03	12.92	13.03	12.97	3.42	6.35	4.33	39.88	39.90	39.89	168.12	168.32	168.22
T6-Downstream1 250'	Top	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Middle	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Bottom	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sample Date February 9, 2001																
T6-Upstream2 500'	Top (0-14)	9.28	9.59	9.39	11.84	14.69	13.31	4.40	6.35	5.12	40.32	40.37	40.34	154.32	157.29	155.79
	Middle (14-28)	9.20	9.34	9.25	13.10	13.19	13.13	4.40	5.86	5.03	40.32	40.33	40.32	154.50	157.62	155.81
	Bottom (28-44)	9.18	9.33	9.22	13.08	13.15	13.11	4.40	6.35	5.06	40.32	40.34	40.33	154.87	157.86	155.69
T6-Downstream2 50'	Top (0-19)	9.18	9.36	9.25	11.29	13.69	13.23	4.88	6.35	5.33	40.33	40.37	40.35	155.32	158.40	156.95
	Middle	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Bottom	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
T6-Downstream2 100'	Top (0-15)	8.95	9.10	8.99	10.28	13.65	13.22	4.40	6.84	5.49	40.17	40.32	40.25	158.52	161.77	161.40
	Middle (15-30)	9.03	9.24	9.09	12.98	13.11	13.05	4.40	9.28	6.24	40.13	40.24	40.20	161.59	161.93	161.72
	Bottom (30-45)	9.12	9.25	9.19	12.93	13.07	13.01	5.86	40.54	19.49	40.19	40.23	40.21	161.63	161.82	161.74
T6-Downstream2 250'	Top (0-14)	8.70	8.99	8.83	11.58	13.55	13.13	4.88	7.33	6.05	40.37	40.42	40.40	158.06	158.34	158.20
	Middle (14-28)	8.96	9.09	9.02	12.98	13.05	13.02	5.37	6.84	5.91	40.38	40.41	40.39	158.29	158.41	158.36
	Bottom (28-43)	9.07	9.17	9.11	12.98	13.04	13.01	5.37	6.84	5.98	40.38	40.40	40.39	158.21	158.38	158.30
T6-Downstream2 Offshore 100'	Top (0-15)	9.03	9.16	9.05	11.51	13.70	13.28	4.88	5.86	5.36	40.24	40.29	40.27	158.68	161.53	161.40
	Middle (15-30)	9.04	9.27	9.11	13.01	13.15	13.08	4.88	8.30	6.23	40.18	40.28	40.22	161.38	161.69	161.54
	Bottom (30-45)	9.13	9.28	9.17	12.98	13.10	13.02	6.35	24.42	16.29	40.18	40.24	40.20	161.55	161.81	161.73
T6-Downstream2 Nearshore 100'	Top (0-15)	9.16	9.26	9.20	11.68	13.73	13.32	4.40	5.86	5.12	40.24	40.38	40.31	158.49	161.65	160.38
	Middle (15-30)	9.15	9.26	9.18	13.05	13.20	13.12	4.40	6.35	5.02	40.24	40.29	40.26	158.81	161.74	161.58
	Bottom (30-45)	9.13	9.24	9.19	12.89	13.13	13.02	4.40	65.45	18.90	40.22	40.37	40.33	158.58	161.79	158.92

Notes:
[1]: pH of Terminal 6 sampling stations exceeding the Water Quality Standard of pH 8.5 may indicate Seabird® CTD was out of calibration.
NA: Not Available
[ ] Indicates Water Quality Excursion.

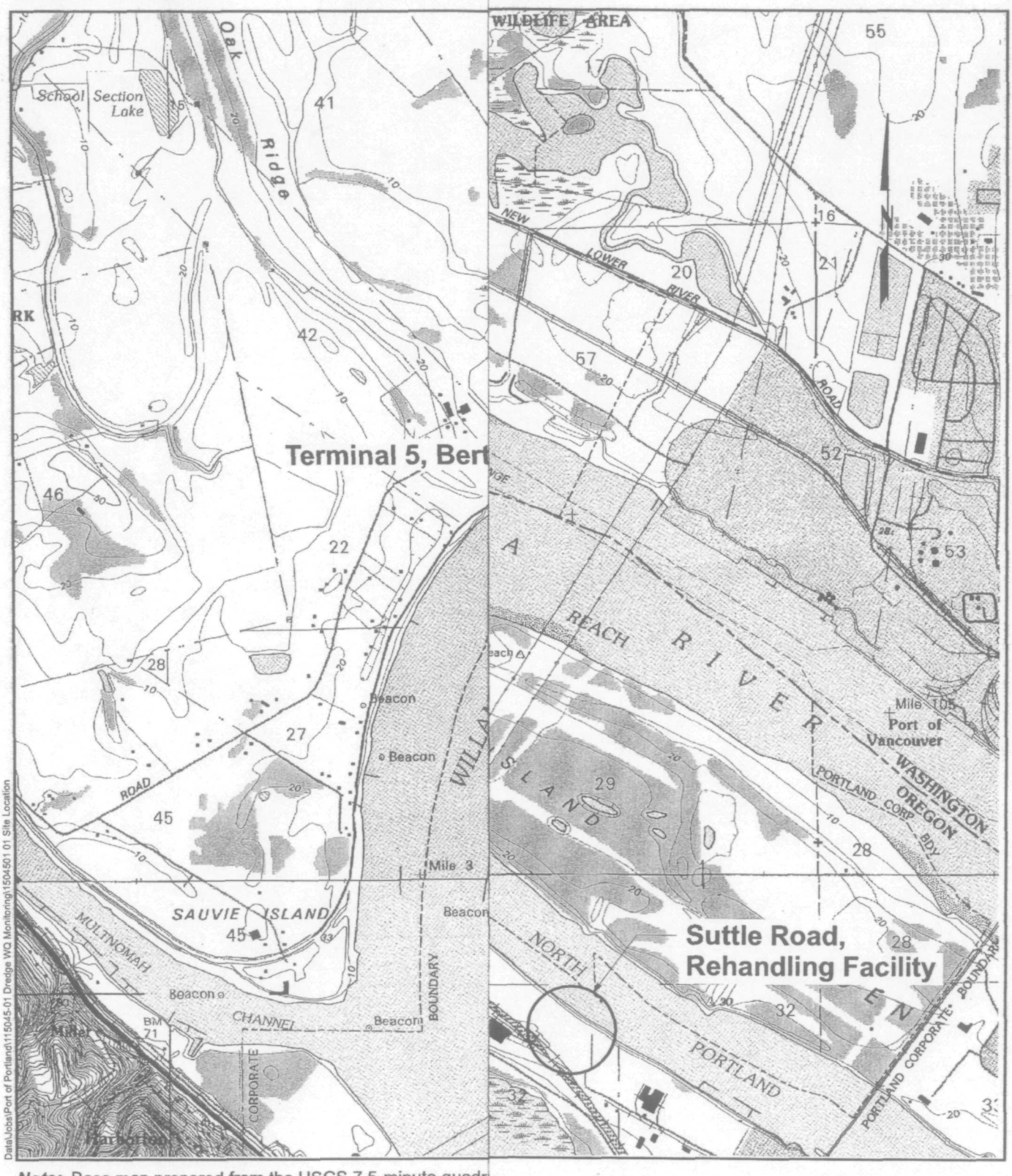
Table 2 - Analytical Results for Mid-Water Column Samples
Port of Portland
Portland, Oregon

Hart Crowser
J-15045-01

	Ambient Water (1999) EPA Freshwater Criteria[1] (µg/L)		Ambient Water (1988) OAR Freshwater Criteria[2] (µg/L)		Drinking Water (µg/L)		Terminal 5, Berth 503				Terminal 6, Berths 603-605			
	CMC	CCC	Acute	Chronic	OAR Drinking Water MCL[3]	EPA-9 PRG Tap Water[4]	T5-Upstream1 500 ft	T5-Upstream2 500 ft	T5-Downstream 100 ft	T5-Downstream 250 ft	T6-Upstream 500 ft	T6-Downstream 50 ft	T6-Downstream 100 ft	T6-Downstream 250 ft
Total Suspended Solids (mg/L)	--	--	--		--	--	9	10	5 U	8	5 U	6	5 U	8
Butyltins (µg/L)														
Tributyltin (TBT) Unfiltered	0.46†	0.063†	--	--	--	--	0.006 J	0.008 J	0.02 U	0.008 J	0.02 U	0.02 U	0.02 U	0.02 U
Tributyltin (TBT) Filtered	--	--	--	--	--	--	--	--	--	--	0.02 U	0.02 U	0.02 U	0.02 U
LPAHs (µg/L)														
Acenaphthene	--	--	1700	520	--	--	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U
Acenaphthylene	--	--	--	--	--	370	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U
Anthracene	--	--	--	--	--	--	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U
Fluorene	--	--	--	--	--	1800	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U
Naphthalene	--	--	2300	620	--	240	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.043
Phenanthrene	--	--	--	--	--	6.2	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U
2-Methylnaphthalene	--	--	--	--	--	--	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.024
HPAHs (µg/L)														
Benz(a)anthracene	--	--	--	--	--	0.092	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U
Benzo(a)pyrene	--	--	--	--	--	0.0092	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U
Benzo(b)fluoranthene	--	--	--	--	--	0.092	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U
Benzo(k)fluoranthene	--	--	--	--	--	0.92	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U
Total Benzofluoranthenes (b+k)	--	--	--	--	--	--	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U
Benzo(g,h,i)perylene	--	--	--	--	--	--	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U
Chrysene	--	--	--	--	--	9.2	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U
Dibenz(a,h)anthracene	--	--	--	--	--	0.0092	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U
Fluoranthene	--	--	3980*	--	--	1500	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U
Indeno(1,2,3-cd)pyrene	--	--	--	--	--	0.092	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U
Pyrene	--	--	--	--	--	180	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U
Dibenzofuran	--	--	--	--	--	--	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U
Pesticides (µg/L)														
alpha-BHC	--	--	--	--	--	--	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
beta-BHC	--	--	--	--	--	--	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
delta-BHC	--	--	--	--	--	--	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
gamma-Chlordane	--	--	--	--	--	--	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
4,4'-DDD	--	--	--	--	--	0.28	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
4,4'-DDE	--		1050	--	--	0.2	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
4,4'-DDT	1.1	0.001	1.1	0.001	--	0.2	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Total DDT	--	--	--	--	--	--	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Aldrin	3	1.3	--	--	--	0.004	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Chlordane (alpha)	2.4	0.0043	--	--	--	0.19	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Dieldrin	0.24	0.056	--	--	--	0.0042	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Endosulfan	0.22	0.056	--	--	--	220	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Endosulfan II	--	--	--	--	--	--	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Endosulfan Sulfate	--	--	--	--	--	--	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Endrin	0.086	0.036		--	0.2	11	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Endrin Aldehyde	--	--	--	--	--	--	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Endrin Ketone	--	--	--	--	--	--	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Heptachlor	0.52	0.0038	--	--	--	0.015	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Heptachlor Epoxide	0.52	0.0038	--	--	--	0.0074	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Lindane	0.95	--	--	--	4	0.052	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Methoxychlor	--	--	--	--	100	180	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Toxaphene	0.73	0.0002	--	--	5	0.061	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

Notes:
-- Not Available
CMC: Criteria Maximum Concentration
CCC: Criterion Continuous Concentration
[1] EPA National Recommended Water Quality Criteria (April 1999)
[2] *Oregon Administrative Rules (OAR) Freshwater Chronic Criteria, Chapter 340, Division 41 (Table 20)*
[3] OAR Drinking Water Criteria, Maximum Contaminant Level (MCL), Chapter 340, Division 41 (Table 20)
[4] EPA Region 9 Preliminary Remediation Goal for Tap Water
† This value is a proposed aquatic life criterion to be considered for adoption; EPA has not responded to public comment for this value
* Insufficient data to develop criteria; value presented is the Lowest Observed Effect Level (LOEL)

Site Location Map
Port of Portland
Portland, Oregon



DataJobs\Port of Portland\115045-01 Dredge WQ Monitoring\15045001 01 Site Location

Note: Base map prepared from the USGS 7.5-minute quadr

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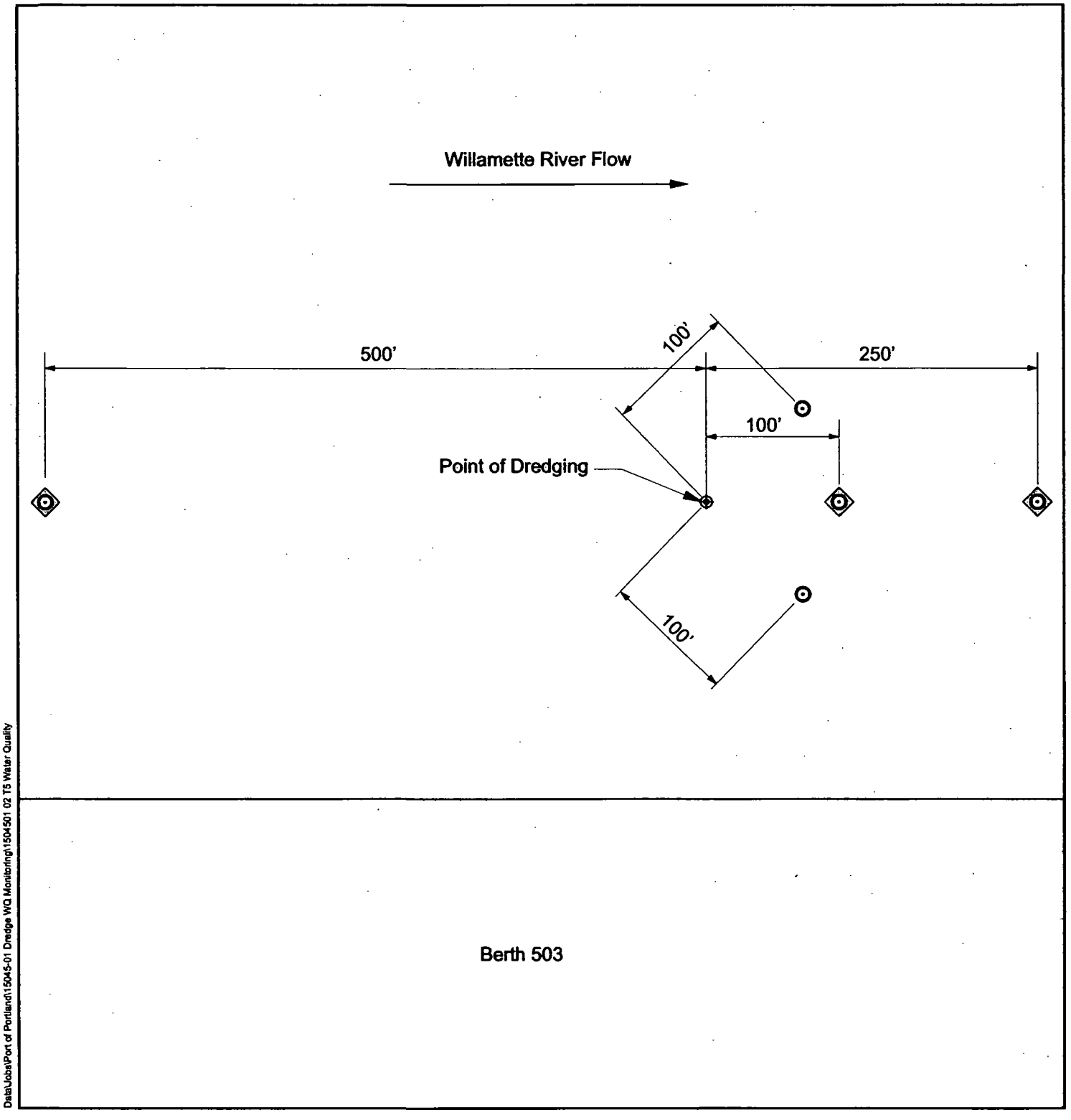
Figure 1

Water Quality Monitoring Program at Terminal 5, Berth 503
Port of Portland
Portland, Oregon



DataUobs\Port of Portland\15045-01 Dredge WQ Monitoring\15045-01 02 T5 Water Quality

Not to Scale

Legend

- ⊙ Seabird® CTD Monitoring Location
- ◈ Seabird® CTD Monitoring and Water Column Sample Location

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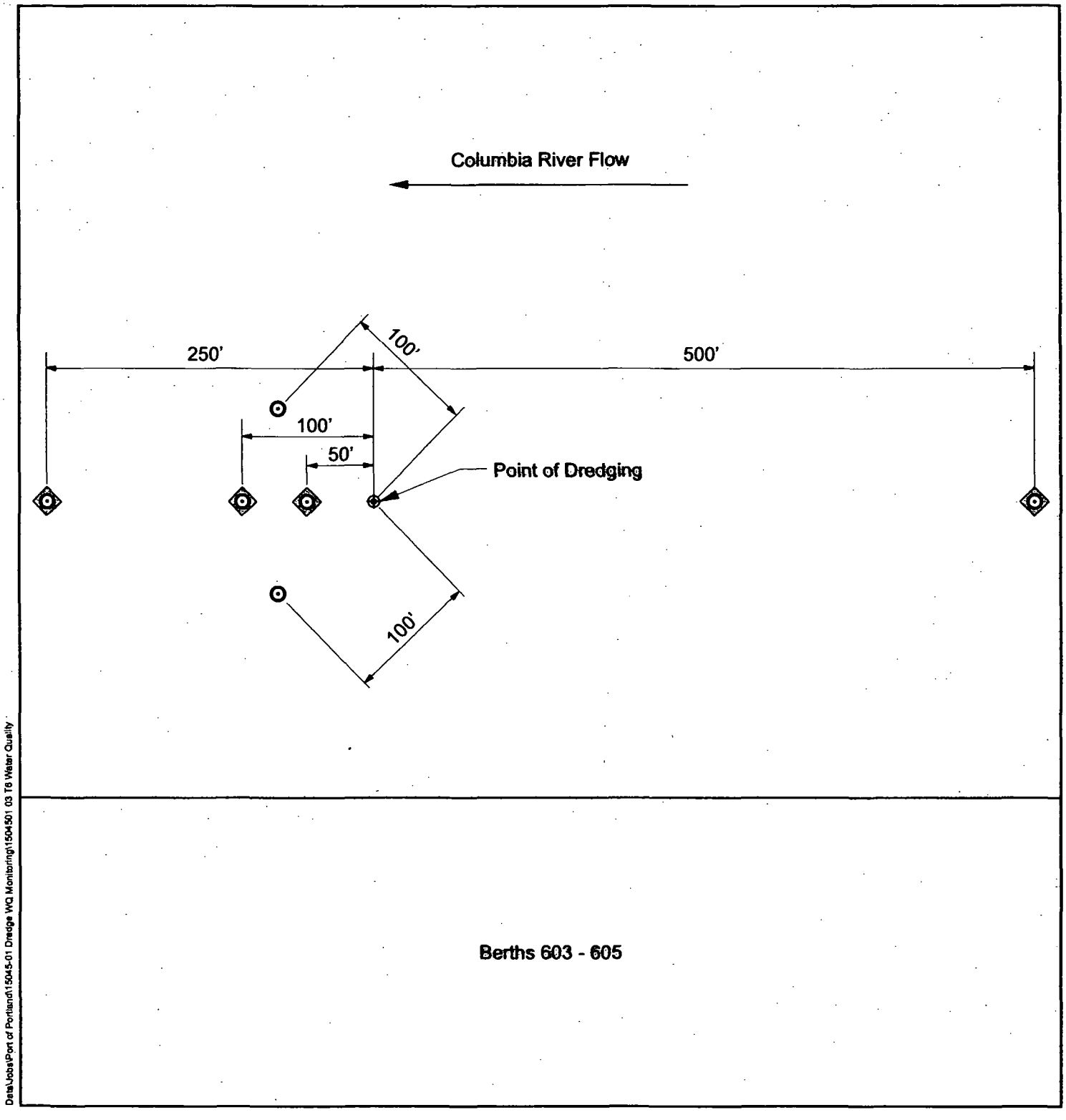
Figure 2

Water Quality Monitoring Program at Terminal 6, Berths 603 - 605
Port of Portland
Portland, Oregon



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Not to Scale

Legend

- ⊙ Seabird® CTD Monitoring Location
- ◈ Seabird® CTD Monitoring and Water Column Sample Location

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Figure 3